SOME NEW BOOKS.

The Latest Book About China.

No one who desires to learn the real causes of the outbreak against foreigners in the northern provinces of the Middle Kingdom in 1900 should fail to read the new book entitled *China and the Powers*, by H. C. THOMSON (Longmans). The narrative is based for the most part upon letters written at the time and afterward to the Manchester *Guardian*, and upon articles written by him for the *Contemporary* and *Monthly Review*. Mr. Thomson has not attempted to offer an account of the siege of Pekin, and he has given only a brief sketch of the Seymour expedition, for the reason that those subjects have been fully and accurately treated in books already published. On the other hand, he has recounted at length the investment and bombardment of the foreign settlements at Tientsin, and the assault and capture of the Tientsin native city, because there has been as yet no detailed description of those events. What renders the work before us particularly valuable is the author's discussion of the policies adopted by the various Powers, and his consideration of the position and rights of the Christian missionaries in China, whose future status is one of the urgent questions with which the Powers have yet to deal. Mr. Thomson is one of the few foreign observers who recognize the justice of the claim of the Chinese Government to have the missionary question regarded from their point of view, and not from that of the missionaries alone. It seems to our author that this claim has acquired additional force from the recent refusal of the British Government to admit missionaries into the Soudan, and from the course pursued by the French Government toward various religious orders in France. Not only does Mr. Thomson try to present the Chinese view of the different matters in dispute, as well as the view of the allied Powers, but he frankly avows the conviction that the responsibility for the tragedy of the year 1900 does not by any means rest upon China alone.

In his first chapter Mr. Thomson undertakes to answer the question how it came to pass that the Chinese, who had made so feeble a stand against Japan, made so much more effectual a resistance to all the allied Powers put together. It is pointed out that the Japanese War was purely a war of diplomacy, in which neither the superstitions nor the prejudices of the Chinese people were called into operation. The recent campaign, on the other hand, was essentially a war waged by the *people* of northern China, who carried the Government along with them; a war of religious fanaticism, and, consequently, as difficult to suppress as all such outbreaks are.

What made the so-called Boxer uprising formidable was the fact that, so far as the northern provinces of the Middle Kingdom were concerned, it was, fundamentally, a national movement; an endeavor to obtain freedom from a foreign interference which, to the bulk of the Chinese people, has always been utterly hateful. The bitterness of their aversion has only been intensified by all that has taken place during the last few years, and our author holds that, unless some means can be found to convince them that the foreigners are not the barbarians they think them to be—that they are not actuated solely by a desire to plunder China—the prospects of permanent peace and of resultant security and prosperity, are gloomy in the extreme. Those prospects, he thinks, will never improve until the grievances have been righted which have aroused a keen resentment in the Chinese. It was these grievances that led to the formation of the so-called Boxer Association, which originated in 1899 in the Province of Shan-Tung. Both that province and the Metropolitan province of Chih-li, in which are the cities of Pekin and Tientsin, are comparatively poor, and the bad harvests of the preceding years had given rise to a great deal of distress, which became acute in the winter and spring of 1899-1900. This distress the people imputed to the interference of the hated foreigners, and of their railways and telegraphs, with the Feng-shui, the tutelary deities, or rather the occult and incomprehensible essences inherent in land and water. A site for a house is never selected in China until the soothsayers have given assurance that the Feng-shui of the place will be propitious. Another of the most cherished beliefs of the Chinese, the worship of their ancestors, had been shocked by the disturbance of tombs by the railway lines under process of construction. Such disturbance was inevitable, for the Chinese do not bury their dead in cemeteries, but each family has its own little place of interment, and, China being a country of small landowners, these little graveyards are encountered everywhere, and form one of the principal obstacles to railway enterprise.

Added to these causes of irritation was an ever-present anger against the missionaries for their denunciation of ancestor worship, and particularly, against the Roman Catholics, for using their political influence on behalf of their converts in all kinds of litigation and personal disputes, thereby arousing the bitter antagonism of the Chinese priests, especially the Buddhists, who, from the outset, were the mainstay of the Boxer Association. Moreover, the existent ill feeling was greatly augmented by the concession which the Roman Catholics were able, some three or four years ago, to extort from the Chinese Government, the concession, namely, that their clergy should be invested with Mandarin rank, their Bishops to have the rank and status of a governor of a province, and their missionaries that of a Taotai, or Magistrate. A like concession was offered by the Pekin Government to Anglican Bishops and missionaries, but Lord Salisbury, after consultation with the Archbishop of Canterbury, declined to permit them to accept it, as it might lead them to an undesirable assumption of political power.

All these causes put together lit up the smouldering hatred all foreign devils which is one of the strongest sentiments a Chinaman has, and so it came to pass that a secret society was formed in Shan-Tung [illegible]

upholder in their earlier days. After the murder of Mr. Brooks, a British missionary, he was removed from office as an ostensible mark of Imperial displeasure, but his subsequent appointment to the Governorship of the province of Shansi, and the acceptance of the leadership of the Boxers by Prince Tuan, father of the child who was then the Heir-Apparent, were generally accepted as proofs that the anti-foreign movement was viewed favorably by the Empress Dowager, and the clique of Manchu Ministers who, since 1898, had usurped the Government of China.

Nevertheless, Mr. Thomson is convinced that, but for the unwarranted capture of the Taku forts by the squadrons of the allied Powers on June 17, 1900, the Boxers would have failed to secure the open approval of the Pekin Government, the German Minister would not have been murdered, the Foreign Legations in Pekin would have been free from danger, and the Seymour relief expedition despatched from Tientsin to the capital would have been successful. The dates seem to be conclusive on these points. It was on June 16, 1900, that the allied admirals—except Admiral Kempff, who rightly refused to take part in the high-handed proceedings—sent an ultimatum to the Chinese commander of the Taku forts calling upon him to surrender them before 2 o'clock on the following day. Instead of complying with this preposterous demand on the part of Powers with which his country was at peace the Chinese commander opened fire, and the forts were taken on June 17. Observe that telegraph communication with the capital was open at the time. It was not until June 18 that Admiral Seymour was attacked by well-armed Chinese troops. Up to that moment, he had been assailed simply by Boxers, equipped with swords, and spears, and a few rifles. It was on June 19 that the Chinese Government, reasonably assuming that the attack upon the Taku forts amounted to a declaration of war, ordered the representatives of the foreign powers at Pekin to leave the city within twenty-four hours. It was on the following day that the German Minister was killed in the street on his way to an interview with the Tsung-li-Yamen, and it was in the afternoon of the same day that the Chinese troops opened fire on the legations.

Mr. Thomson, for his part, has no doubt that it would have been wiser to delay the seizure of the forts until at least Admiral Seymour had either got safely through to Pekin, or had made good his retreat to Tientsin. He holds that the effect produced by the attack on the forts was precisely what might and should have been anticipated. "It is said that one of the most influential of the Chinese officials, a man greatly trusted by the Imperial Court, had actually prepared a petition to the Emperor entreating him to suppress the Boxers and to protect foreigners, but, when the news came of the capture of the forts, he tore it up, with the words that the Powers had made war upon China, and that there was nothing for it but to resist to the end. Every patriotic Chinaman felt the same." Our author goes so far as to charge that those who were responsible for the attack on the forts perfectly understood what would be the result of their proceeding. What they did not understand was the increased military strength of the Chinese; they supposed it might be disregarded. A few days before the attack was decided upon, the question, it seems, was discussed in Tientsin, and one of the consuls remarked: "If you take the forts, you will be signing the death warrant of every foreigner in the interior." The prediction was borne out by the event. The terrible massacres in the inland provinces, with one exception, all took place after June 17, the date on which the forts were occupied. The Shansi missionaries who escaped to Shanghai declare that all went well until then. So, too, the missionaries who came down from Manchuria averred that they were perfectly safe there until the news came of the capture of the forts, when they had to fly for their lives. The excuse given by the allied admirals for their premature and ill-advised demonstration, is that it was doubtful how long the regular troops would have resisted the temptation to join the Boxers, and that, had they done so, and had the forts not been taken when they were, these would, undoubtedly, have been strongly reinforced, the river communication intercepted, and all access to Tientsin severed. That at the time of the taking of the forts these apprehensions were not warranted is evident from Sir Claude Macdonald's despatch of Sept. 20, 1900, in which he says: "We had up to this moment (June 19, 1900), no information whatever that Tientsin was in any danger, still less that the line to Taku was menaced, and we, therefore, failed to understand the urgency of the naval authorities' action, and were inclined to construe it as premature, if not needlessly provocative." Additional grounds for this opinion are furnished in the book before us. For example, Mr. Thomson recalls that the Chinese soldiers in the Taku forts had remained passive while troops and guns had been sent up from the allied fleets to Tientsin. They even allowed the cruisers by which the bombardment was effected to anchor unmolested in the river, and storming parties to be sent on board from the warships lying outside the bar. "Still more significant is the fact that the General in command of the neighboring Pei-tang forts intimated that, so long as he was left alone, so long would he take no action, but that, if he were attacked, he would be obliged to defend himself. So it is quite possible that the commander of the Taku forts might have pursued a similar course had his hand not been forced by the demand of surrender. The compact thus tacitly entered into with regard to the Pei-tang forts was maintained until Sept. 19, long after the fall of Pekin."

The author of this book, who speaks as an eyewitness, testifies that the outrages committed by the Chinese were insignificant compared with the inhuman butchery and awful devastation perpetrated by some of the allied contingents. [illegible]

cannot be disregarded. Mr. Thomson's protest against the shocking treatment of the Chinese by many of the allied troops has been supported by Dr. Morrison, the correspondent of the London *Times*, and independent testimony on the point is adduced in the book before us from the Japanese *Daily Mail*, which, on Nov. 10, 1900, summed up as follows the comments on the conduct of the allied troops made by Mr. Taguchi Ukichi, a member of the Japanese House of Representatives: The reason for passing over in silence the conduct of the German and French soldiers will be obvious. "With regard to the Indian soldiers he alleges that their one fault was a disposition to commit petty larceny whenever opportunity presented itself. For the British officers he has only praise; they were beyond criticism. The American troops, however, seem to have elicited his warmest approbation. He praises them from every point of view. Mr. Taguchi Ukichi further says that his experiences in China have reconciled him to the conscription system in Japan. Much of the ferocity and callous cruelty displayed by the Russians is due, in his opinion, to the fact that they are professional soldiers; like the Samurai of old, they have lost their bowels of mercy. The conscript, on the contrary, has not time to get demoralized by military service. As for the Japanese, Mr. Taguchi Ukichi claims that their discipline and orderliness were excellent, but it is absurd, he says, to allege that they did not take their share of the spoils. The difference was that the individual Japanese soldier never looted on his own account. They worked in bodies, securing the booty for the public account. At Tung-Chow they captured the rice granaries and quickly appropriated the contents. At Pekin they went straight for the Treasury, and carried off from two to three million taels worth of sycee, loading the silver on horses and transporting it to the Japanese legation."

Mr. Thomson goes on to remind us that, in addition to the thirst for blood, many of the allied troops evinced a longing for plunder, which is attributed in great measure to the recollection of the rich booty obtained in 1860 from the Summer Palace. This longing became so ungovernable that even several of the houses of the foreign residents in Tientsin were completely gutted. If it was difficult to protect the Europeans, it was impossible to protect the Chinese, and little effort was made to do so. After noting that no compensation was possible for the thousands of innocent natives who were ruined, our author submits that there was a judicial aspect of the matter which ought to have been taken into account when the sum total of the indemnities to be paid by China was under discussion. Attention is directed to the fact that by The Hague Convention, to which China was a party, pillage was formally prohibited. Another article provided that "family honors and rights, individual lives and private property, as well as religious convictions and liberty, must be respected. Private property cannot be confiscated." It is clear, in view of these provisions to which they had subscribed that the allied Powers, by failing to restrain illegal pillage and by permitting the wholesale destruction of private property, committed a flagrant breach of international law, and an agreed sum in respect to the loss thereby inflicted upon China ought to have been deducted from the amount of the indemnities claimed.

The author of this book has no wish to palliate or excuse what was really treacherous in the conduct of the Chinese Government, or the cruelties of the officials acting under its orders. He insists, however, that unless some attention be paid to the Chinese case, which, in many ways, he deems a strong one, it will be impossible to understand what can have induced them to act as they did, and it will be equally impossible to take measures for guarding against a repetition of such behavior in the future. In his opinion it cannot be denied that the commercial wars waged against China by Great Britain and France in the middle of the nineteenth century did much to justify the dread of intrusion which the Chinese have always felt, regarding intrusion as the thin edge of the wedge which would some day rend their country asunder. "It is every day becoming more evident that the open and undisguised way in which the coming partition of China is discussed, the unseemly scramble for concessions, and, still more, the seizures of portions of Chinese territory, seizures in which almost all the great Powers joined, have had a far more potent influence in bringing to a head the latent hatred against foreigners than the much-talked-of friction with the missionaries of whom the politicians of Europe are now anxious to make scapegoats."

It is, at the same time, a characteristic feature of this book that the author, while acknowledging that the acquisitions of territory and not the missionaries have furnished the chief provocations to revolt, maintains that the missionaries also have contributed, in proportion as they have caused themselves to be looked upon, not as evangelists pure and simple, but as emissaries, acting on behalf of their respective governments. Mr. Thomson believes that never will missionary enterprise in China really flourish until the missionaries dissociate themselves altogether from political affairs. The fact is recalled that the Taiping Rebellion was nominally a revolt undertaken by native Christians, and, although it was put down with the assistance of Great Britain, it was inevitable that the court and the official classes should hereafter regard Christianity as a grave danger. "It is not necessary," says the author, "to follow step by step the various occasions on which the murder or ill treatment of a missionary has been made use of as a pretext for political and commercial aggression. [illegible]

those accorded to the others. It is quite clear, in view of the fact thus set forth, that the right claimed by the missionaries of all the Powers except Russia to acquire land and erect mission buildings, although it has been tacitly acquiesced in by the Chinese for many years, because they were afraid to contest the point, rests, nevertheless, on an initial fraud, thereby violating from the outset the assertion ostentatiously made that "the Christian religion teaches man to do as he would be done by." Our author holds that "the privilege ought to have been at once and indignantly rejected by the other missionaries concerned when it was put forward by the French. It is the canker which has eaten into all subsequent evangelization and has contributed in no small degree to the recent terrible outrages, for there is nothing the logically-minded Chinaman resents so much as a deliberate and unatoned act of injustice. It cuts, indeed, at the very root of missionary influence: 'Thou, therefore, which teachest another, teachest thou thyself? Thou that teachest a man should not steal, dost thou steal? Thou that makest thy boast of the law, through breaking the law, dishonorest thou God?'"

Over and over again does the author of this book repeat that the feeling against the missionaries was caused, not by their tenets or by the quiet exercise of their religion, but by the use made of them by their different Governments, and still more by their harmful intermeddling on behalf of their converts in the courts of law. There is no doubt always a strong temptation for missionaries to side with their own people; this temptation was rendered almost irresistible by the imperial decree previously mentioned which the Roman Catholics succeeded in obtaining about the middle of 1899. As this decree conferred upon Bishops the status of Governors and upon priests that of taotais or Magistrates, it gave them, as a matter of course, the right of audience in the courts which they had not before possessed.

We observe, finally, that the conclusion reached by the author in regard to the missionary question is shared, he says, by many of the ablest and most experienced of the missionaries themselves. It is thus outlined: "When order has been restored, and missionaries are once more able to proceed into the interior, they should be permitted to do so only under a strictly enforced passport system. As for women missionaries, they should no longer be allowed to live by themselves, as they do now, in distant provinces and in towns far removed from the Treaty Ports, and with no white men near to assist them in case of need. In future, too, all missionary bodies should be restricted to the bare right of travel granted by the Treaties of Tientsin; and the privilege of residence and of acquiring property and land assumed by them upon the strength of the fraudulently interpolated clause in the French convention of 1860 should be abandoned." The conviction is expressed that the missionaries are more likely to succeed if they limit themselves to the Treaty Ports and to frequent journeys of visitation and inspection to the interior, trusting to native pastors and catechumens to carry on the work thus initiated. In a word, China should be Christianized from the inside rather than from the outside. Christian propagandists are more likely to achieve success by working in this manner than by forcing themselves upon the Chinese against their wish in their present sullen and resentful mood, especially as such intrusion is attended with the constant danger of bringing about massacres that, in turn, cause punitive expeditions, which do more than anything else to retard the progress of Christianity. "The irony of the present situation is rendered the more keen by the fact that France, so zealous in her endeavors to force Catholicism upon the Chinese, has rejected it for herself; and that Germany, now solicitous that the martyred Chinese Christians should be dearly avenged, was quite indifferent to the more terrible fate of the Christians in Armenia." From such contrasts, is it possible for the Chinese to draw any other deduction than that the Christianity of modern States is only a convenient political weapon, to be taken up or laid aside as the exigencies of the moment may dictate?

M. W. H.

The Sea-Coast and Its Erosion.

A book which ought to be read by every one concerned in the preservation of land adjoining our seacoast and especially those sections of it which have become pleasure resorts, is the work entitled *The Sea-Coast*, by W. H. WHEELER, member of the British Institute of Civil Engineers (Longmans). In no branch of engineering has so much money been expended on useless work as in that which aims at the protection of land adjacent to the coast. Even in Holland, the existence of which depends on the maintenance of its sea walls and defences, the authorities are divided upon important questions, both of principle and of practice. For several years the author of this volume has made a special study of the question of coast erosion and littoral drift and of the various means pursued for the safeguarding of the seacoast from destruction. He has not only inspected the greater part of the coast of England from Northumberland on the east to Cumberland on the west, but also the shores of Holland, Belgium and France, and has thus made himself acquainted with the various measures that have been taken to prevent the erosion of beaches and to assure their protection through sea walls and other bulwarks. In the earlier chapters due consideration is given to the laws that govern the action of waves breaking on the shore and the effect produced by them on the beach, and also to the conditions under which material is drifted along the coast. The examples subsequently presented should permit a more correct conclusion to be reached from the lessons taught by experience than if theoretical laws alone were followed. The author's purpose is not to advocate any special system of coast protection, but to afford such information as to the varying geological and tidal conditions attaching to seacoasts and the effect of protective works carried out under different degrees of exposure as may be of service to those interested in the preservation of land bordering on the sea. We are warned, however, that any principles propounded or conclusions drawn in these pages must only be considered as applying to the shores of England, France, Belgium and Holland, or to tidal coasts having the same characteristics. We add that the word "shore" is here used to denote the margin of the sea above high water, and the word "beach" the space between the high water and low water line.

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have been erected on them. Along those parts of the coast, also, where the land is preserved from inundation by natural sand dunes or artificial enbankments, the preservation of the beach is a matter of absolute necessity. Where, however, the land is used for agricultural purposes, and is not of more than ordinary fertile character, the cost of the preservation of the cliffs on which such land is situated may be greater than the value of the land. By way of example Mr. Wheeler cites a section of the Yorkshire coast, where the value of the land is less than one-third of the sum which would have to be expended to protect it.

The waste and destruction of coasts, apart from interior causes, such as weather and land-slips due to want of drainage, are caused by the action of waves breaking against them during on-shore gales and high tide. It is essential, therefore, that attention should be paid to the laws governing the action of shore waves on beaches, cliffs and sea walls. Now the height of a wave, its length and the velocity with which it moves, are all governed by the depth of the water. The force of a breaking wave and its percussive effect on a cliff or sea wall are, therefore, in proportion to the cube of the depth of the water in which it breaks. The percussive force of the blow, however, is diminished in proportion to the angle at which the wave strikes the object with which it comes in contact either horizontally or vertically. In other words, the force of waves on the beach varies with the slope. The flatter the beach and the shallower the water, the less the eroding and the transporting effect of the breaking waves. For this reason shingle or pebbly beaches, lying, as they do at steeper slopes than sand beaches, are more affected by gales, and there is a much greater disturbance of material.

The power of waves, caused by heavy gales, in drifting material on a beach, in moving heavy stones or in the destructive effects due to percussive action on cliffs and sea walls, is almost incredible. Stones of considerable size are frequently cast on to the top of banks eight to ten feet above high water. At Brighton it is recorded that in southwest gales the shingle (as the pebbly, superficial stratum of the beach is called), has been thrown on to the road eighteen feet above high-water level. On one occasion, during a heavy gale from the southwest, Sir John Coode ascertained by measurements that three and three quarter million tons of shingle had been torn down from the Chesil Bank (situated at the east end of Lyme Bay), and carried seaward by the waves; on another occasion, four and a half million tons were scoured out, three-fourths of which was moved back after the gale ceased. During a heavy gale in the winter of 1824 a laden sloop of 100 tons burden ran on the Chesil Bank, and was carried by a wave and cast on the top of the bank at a place where it was more than thirty feet above ordinary high water. At Hove (adjoining Brighton) it was calculated that 27,000 tons of shingel were removed from the beach in a heavy gale during one set of spring tides, and that 10,000 tons were drifted along the beach in two tides on another occasion. In the Solent near Hurst Castle, a shingle bank, two miles long and twelve feet high, consisting principally of flints resting on a clay base, was moved forward in a northeasterly direction forty yards during a storm in 1824. On more than one occasion at Plymouth during the construction of the breakwater, large blocks of stone, some of them weighing seven to nine tons, were removed from the sea-slope of the breakwater at the level of low water, carried over the top to a distance of 138 feet, and piled up on the inside. In one night 200,000 tons of stone were thus removed. At Peterhead, where a breakwater is being extended out to deep water for a harbor of refuge, and where the sea-exposure is very great, waves of thirty feet in height and from 500 to 600 feet in length, are occasionally encountered during heavy gales. On three occasions during storms, blocks weighing over forty tons each have been displaced at levels below low water, varying from seventeen to thirty-six feet, and the water has been thrown upward 120 feet.

In a chapter on "Littoral Drift," Mr. Wheeler directs attention to those natural guards of seacoasts which are known as sand-spits. On some sandy coasts where there is a predominant drift in one direction, the sand is formed into spits, consisting of long, narrow banks, which, commencing at some salient point, run for a considerable distance in a direction parallel to the general coast line, leaving a protected bay or harbor inside. These long, narrow spits, forming natural breakwaters, although existing in great depths of water and exposed to the storms and waves of the ocean, maintain their position in a remarkable manner, the waste due to storms being made up by fresh deposits of littoral drift. They sometimes extend from five up to 100 miles in length, and are situated in depths of from twenty to thirty feet of water. In some cases, owing to the strong current, caused by the contraction of the space through which the flood and ebb current runs to fill the embayment, the end of the spit is turned into the form of a hook. Our author cites some notable examples of sand-spits on the east coast of the United States and in the Gulf of Mexico. The best known of these is Sandy Hook at the entrance of the bay of New York. The approach to this bay from the Atlantic lies between two projecting sand-spits six miles apart. The flood tide coming from the south sets toward the Narrows in a northwesterly direction, while, on the north side, the flood current striking Long Island, curls round and sets in a westerly direction toward the Narrows. The two spits, Sandy Hook on the one side of the entrance, and Coney Island on the other, have drifted in the same direction as the two currents of the flood tide. Sandy Hook is six miles long and three-quarters of a mile wide, the depth of water close to it on both sides being from twenty-five to thirty feet; the east side is exposed to the full range of the Atlantic Ocean. Coney Island projects one and a half miles in a westerly direction, and is about half a mile wide. We are told that the way in which Coney Island projects across the channel, with Gravesend Bay behind it, bears a strong resemblance to Spurn Point on the Humber.

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Another of nature's safeguards is the [illegible]

sand-dune. Low, sandy, exposed shores are frequently bordered by mounds of sand blown off the beach by the wind. These mounds, commonly termed dunes, are known by various local names in different sections of the English sea-coast. They afford protection to the low land lying behind them from the high tides, and, in some cases, advance, themselves, upon the land, covering it with sand and burying houses and churches, and, in some cases, whole villages. But for the protection of its dunes, there would be little left of Holland. We are told that the Dutch and the Danes "deal as carefully with their dunes as if dealing with eggs, and talk of their fringe of sand-hills as if it were a border set with pearls. These dunes are connected with their system of dykes, and sentries are posted all along their length to repair and defend them against wanton injury." The sand on dunes is held together by the roots of the grass known as "marram," "star-grass," or "sea-mat," the roots of which penetrate a long way into the sand for moisture, attaining sometimes a length of thirty-six feet, and thus bind the sand together, while the grass checks the action of the wind on the surface. It has been calculated that a single plant of mat-grass will have lateral shoots radiating from a single stem ten to twelve yards long, forming a circle twenty yards in diameter, and that a plant of this grass in one year will multiply itself five hundred-fold. The growth of the grass can be promoted in bare places on newly-formed dunes by removing tufts from the older dunes, and planting them in the sand. The holes are dug with the hand, the tuft placed in and the sand pressed round it. One or two rows of reeds are then set in the sand projecting about four feet from the surface. The sand drifting along the beach is caught by the reeds, almost burying the tufts of grass, which, however, soon make their way through. As the sand grows up, fresh plantings of grass and reeds are made. By this means bare places in the dunes are extended seaward, and the toe of the slope is made good when it has been cut out by storms. The mat-grass is sometimes cut for thatching and similar purposes, but this practice is considered detrimental to the maintenance of the dunes. Its leaves are nutritious food for cattle, and it is also used in Europe for making cordage and netting.

On the southern side of the English Channel and North Sea the dunes, beginning soon after the chalk cliffs cease, extend in an almost unbroken line from Calais to the Texel. On the French coast they vary from a quarter of a mile to nearly a mile in width, and are from 50 to 80 feet in height; along Belgium they are from 1,500 to 2,000 feet in width, and from 50 to 60 feet in height, the highest being over 130 feet above sea level. Holland, as we have said, depends almost entirely for its protection from the sea upon the sand dunes, which are from one to three miles wide, but only from 40 to 50 feet in height. On the coast of Brittany the sand dunes, driven landward by northwest winds, have rendered a canton uninhabitable, by covering it with twenty feet of sand. The tower of the church and chimneys of the buried houses are still occasionally visible. The most striking examples of dunes are to be found on the shores of the Bay of Biscay, where the sand hills extend for 150 miles, from the cliffs at Biarritz to the Point de Grave, at the mouth of Gironde, occupying an area of about 500 square miles. Along this space at one time there existed a vast bay, which became covered with sand raised above sea level and was as bare of vegetation as the Desert of Sahara. The southern portion of this vast sandy area is known as the Landes. Until checked by the measures that began to be taken by the French Government about the end of the eighteenth century the sands in this region advanced landward at a rate variously estimated at from five to thirty-five yards a year, burying in their progress forests, farms, vineyards, villages and churches. Some of these, after being buried for many years, were again uncovered, owing to the sands having moved further inland. The old Roman road leading from Bordeaux to Bayonne was engulfed, and the Church of Legé, taken down at the end of the seventeenth century and rebuilt two and a half miles inland, had again to be removed 160 years afterward, showing an advance of the sands at this point of 27 yards a year. The landward progress of the dunes has been arrested by planting the sea lyme-grass and firs. About 200,000 acres of sand dunes and sand hills have been thus planted, and a large forest has been called into existence, which, not only has given solidity to the movable sand but converted it into valuable ground. These artificial pine forests have greatly improved the health of the district, and form one of the chief attractions for visitors to Arcachon.

In Denmark the dunes cover an area of more than 260 square miles, varying from a narrow row of hills to a width of six miles and a height of twenty feet. The average rate of advance landward is from three to twenty feet a year. As the sand advances, the ruins of the buildings which in former times were buried are exposed. On the south shores of the Baltic the dunes extend in an almost unbroken chain from the north point of Jutland, a distance of 300 miles. In Prussia they occupy an area of 100,000 acres. Here the same system of grass planting has been pursued as in Denmark. Sand dunes are to be found in several parts of the coast of the United States. Upon the Atlantic coast the prevalence of westerly winds blowing off shore is not favorable to their formation, but at Henlopen and Hatteras they attain a height of seventy feet, and have filled up a swamp and buried houses and land, so that it is anticipated that in a few years the island lying north of Cape Hatteras will be rendered uninhabitable.

The removal of forests near a seacoast has in some places had a disastrous effect on the country behind them. In the last century the estate of Culbin, near Forres, Scotland, was overwhelmed with irruptions of blown sand, caused by the cutting down of trees and the grubbing up of the star grass which grew on the sand hills. It was the cutting down of the timber in the forests on the west coast of Jutland, which, by removing the resistance to the lower currents of the westerly winds, led to the inland drifting of the sand dunes, and the consequent burying of the cultivated land under sand. [illegible]

has estimated that along the coast south [illegible]

of New York there are not far from 2,000,000 acres of marshes fit for reclamation, which owing to the small rise of the tide and owing to the banks already formed by the sand along nearly their whole length, could be enclosed at a comparatively small expense.

In a chapter on sea walls Mr. Wheeler points out that the ordinary rules for the construction of retaining walls cannot be held to apply to sea walls. The shocks and vibrations to which these are subjected by the percussion of the waves may set in motion the earth at the back, which under other conditions might have remained stable; these forces also tend to disintegrate the material with which the stones of the wall, if this be of masonry, are joined together. The wall is further exposed to disruption by water being forced through crevices into the interior and by the expansion of the air which may exist in any cavities. As regards the height of sea walls, it seems that the top should be sufficiently high to prevent the wave itself, considered independently of the water projected upward as spray, from breaking over it. This height depends on the range of the tide, the exposure of the wall and the height at which the waves in heavy, onshore gales approach the wall. Under ordinary conditions, waves beating against walls made for seacoast protection seldom exceed from 10 to 12 feet in height, one-half of which is above and the other below the normal level of the water. The level of an extraordinary tide may be taken as 4 feet to 5 feet above ordinary spring tide; this estimate would give the top of the wall at high water as from 10 to 11 feet above the level of high water at ordinary spring tides. In sheltered positions and with a good beach in front this height may be reduced. The top of the wall at Hove (adjoining Brighton) is 12 feet above ordinary high water at spring tide, the range of an ordinary spring tide above low water being 20 feet; at Scarborough the height of the sea wall is 13 feet, the range of the tide being 16 feet. The walls at Ramsgate and Margate are from 7 to 8 feet high; here the tide has a range of only 15 feet. At Ostend the top of the sea wall is 12½ feet above ordinary high water, and at Scheveningen 10 feet above the highest known tide or 16 feet above ordinary tides, the range being respectively 17 and 13 feet.

As for the material employed for facing sea walls, it is essential that this, whether used for facing an upright wall, or for pitching a sloping bank, should be of a hard and durable character. Concrete in mass is generally chosen for upright walls, with a facing of stronger material than the body of the walls. Unless great care is exercised in making this facing, it is liable to become broken and disintegrated by the action of the waves, especially where the beach is covered with shingle or pebbles. Concrete has an advantage over masonry walls due to the absence of joints and the smoother face which it affords. At Hove the wall is built with blocks of concrete, the face blocks having flints on the surface bedded four inches deep. For mere protective purposes, and where an economy of outlay is a consideration, sea walls may be constructed of timber. Mr. Wheeler regards ten feet as the greatest height to which such walls should be built when dependence is placed on the strength of the piles used. Beyond this altitude the strength of the timber is not calculated to resist the pressure, and ties have to be resorted to. Pitch pine is frequently used for piling, but this timber is pronounced very uncertain in its strength and lasting qualities. Mr. Wheeler says that no matter how much care may have been exercised in the selection of the wood, it will frequently be found on examination that, in the exposed parts, such as the walings and in the tops of the piles, decay will have set in soon after the construction, and that at the end of ten years this will have extended so much as to impair materially the strength of the timber. Sound Memel fir, creosoted with ten pounds of oil, is recommended as a much more trustworthy material; its life may be computed at three times that of timber which has not been creosoted. Pitch pine will not absorb more than from four to six pounds of oil. It seems that there is little or no advantage to be gained from driving piles beyond a certain depth, inasmuch as fracture will take place at the surface of the ground before the compression of the earth beyond a few feet from the surface allows the piles to move forward. Ten feet is given as the usual limit for main piles, and half this depth for the sheet piles. In determining the depth to which the piles are to be driven, and the strength of the timber, consideration must be paid to the fact that the beach, unless proper protective measures are taken, may be considerably lowered after the piling is constructed, and may thus increase the strain upon the walls.

The cliff-erosion along the Holderness coast of Yorkshire, extending from Bridlington to Kilnsea, has been as great as in any part of England, and nowhere else have such careful records been kept as to the amount of devastation that has taken place. The waste of the cliffs has been estimated at two miles since the time of the Romans, half of the destruction having taken place since the Norman Conquest. On old maps the only record of many villages and townships that at one time existed on the Holderness coast is "washed away by the sea." The townships of Wilsthorpe, Auburn, Hartburn, Withon and Cleton, are all buried in the German Ocean; while other parishes, such as Monkewike, have lost churches, houses and the greater part of their land. Kilnsea Church fell in 1826-36, and the village was removed. Nearly the whole of this parish has been washed away during the last century. Aldborough Church is far out at sea, and Thorpe parish has been reduced from 680 to 148 acres. Of Ravenser and Ravenserodd, once a seaport town at the mouth of the Humber, not a vestige is left. From Danish times there appears to have been a place called Ald Ravenseyr at the mouth of the Humber, built on a tongue of land between two waters; and later on, in the beginning of the thirteenth century a town called Ravenserodd was built on a site where, by the casting up of the sea, sand and stones had accumulated, and it became a seaport town and rival of Grimsby. A royal charter was granted to this place and also a grant of quayage and it became an "exceeding famous borough devoted to merchandise, as well as fisheries, and most abundantly furnished with ships returning Members to Parliament up to the middle of the fourteenth century, when the sea so encroached that the citizens removed their goods to Hull, and by "the wrong-doing of the sea, the town was destroyed, and nothing of value left." This was the last record made of these places.

On another section of the English east coast, namely, near Cromer, there has been a signal loss of land through erosion. According to tradition, there was a Roman settlement on a site opposite Cromer, which site is now two miles out at sea. When Domesday Book was compiled, Cromer was an inland hamlet, and part of the parish of Shipden, a place of considerable extent and importance, nearly the whole of which has disappeared. [illegible]

a solitary ruin, so near the edge of the cliff that, in a few years, it also will be lost.